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§1. Remote Participation Environment on QUEST

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The QUEST (Q-shu University Experiment with Steady State Spherical Tokamak) is a Spherical Tokamak (ST) that starts its operation from 2008. The aims of QUEST project are to establish academic basis of steady-state operation, current drive, and heat load with characteristic magnetic configuration of ST, and its integrated control techniques including advanced PFC control. Since the QUEST is a major tokamak of All-Japan ST Research Program and Joint Usage, the QUEST project is carried out with the cooperation of many researchers of many facilities. In other words, the collaborator's cooperation are indispensable for the effective progress of the QUEST project. This can be applicable in not only the QUEST project but other big projects like the ITER project that many researchers of all over the world participate in. In such a big project, it is important to concentrate the wisdom of mankind for the effective progress, and thus important to establish the ideal experimental environment to organize many researchers cooperation.

In the case of QUEST experiments, several advertisings are attempted to gain the cooperation of many collaborators. One of these attempts is to build and operate the QUEST Community Site (https://www.triam.kyushu-u.ac.jp/community/) that anyone can register in via Internet. This site provides various information such as recent news, experiment schedule, and technical information of QUEST etc. This also provides the circumstances to propose experimental themes and prepublication papers to other QUEST members, and to discuss these proposals on WEB for the high activity of sharing information between the collaborators. Furthermore, the WEB-based Simple Simulation (http://www2.triam.kyushu-u.ac.jp/simQUEST/) is also built, which can calculate the plasma equilibrium, magnetic configuration etc. on WEB. However, although these advertising are important to make familiar with QUEST to many researchers, the remote-participation environments for the collaborators of remote sites are also important.

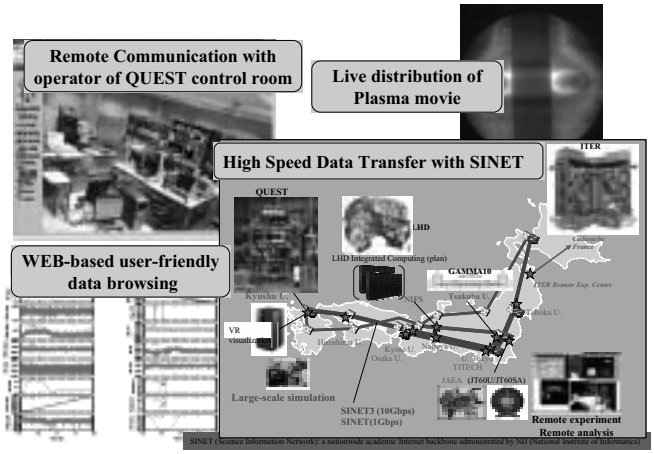

Fig. 1. Several approaches tested on QUEST for seeking ideal remote-participation environment. These are based on high speed data transfer of SNET.

For all of these reasons, the Fusion Virtual Laboratory project is now executed for the establishment of the ideal experimental environment with the collaboration of NIFS. The aims of this project are to create the environment easy-to-join forces of all over the world researchers, and to integrate fusion science resources such as QUEST, LHD, and GAMMA10. (ex. The uniformed user-interface to browse the data of various devices fairly reduces the burden of researchers.) Especially, regarding the QUEST as a mock device of ITER, several approaches listed below are tested and developed for the ideal research & experimental environment (Fig. 1.).

- Remote Communication with operator of QUEST control room
- WEB-based user-friendly data browsing
- Live distribution of Plasma movie, etc.

These approaches are based on SNET which enables the high speed data transfer between the QUEST site and remote facilities sites. The basic ideas of these approaches are to establish the environment easy-to-participate, and to provide the realistic scene as if the collaborators of remote sites stay in the control room of QUEST. For example, in remote communication with operator of QUEST control room, the circumstances of the QUEST control room are distributed by the movie and sound to collaborators, and the collaborators can browse them with just preparing WEB browser, and can communicate with the operator of QUEST in voice with the microphone equipped terminal. Furthermore, in WEB-based user-friendly data browsing, we make great efforts to develop the circumstance that all the data of QUEST can be browsed by just preparing WEB browser. Up to now, the major data of QUEST can be browsed through WEB browser. With the high speed data transfer of SNET, these data are stored on the data server of NIFS site almost as soon as the data acquisition at QUEST site, the collaborators can also browse them without any stress.

Recently new fundamental data such as electro static probe, hard X-ray, and magnetic flux are stored on the data server of NIFS and available on SNET. In future, other fundamental data such as RF-heating input and reflected power that now acquired with CAMAC system will be acquired with the same new system for the continuous data acquisition to prepare against the steady state operation that is one of main targets of QUEST. Furthermore, we continue to make great efforts to seek the ideal experimental environment easy-to-join forces of the remote-site collaborators.